

## **1.3 Box and Whisker Plot**

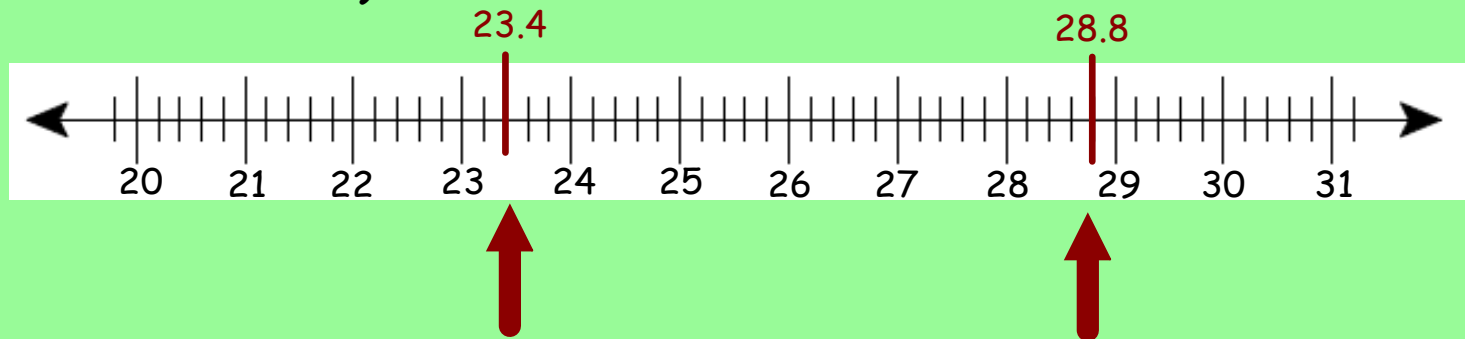
**Box and Whisker Plot** = a type of graph used to display data. It shows how data are dispersed around a median, but does not show specific items in the data.

### **How to form one:**

**Example:** The data below represents how long it took people to eat at a local restaurant. It has been put into order.

23.4	24.3	24.8	25.0	25.1	25.2
25.9	26.1	26.4	27.0	27.3	28.8

1) Draw a number line and mark the **lower** and **upper extremes** (the least and greatest data values).

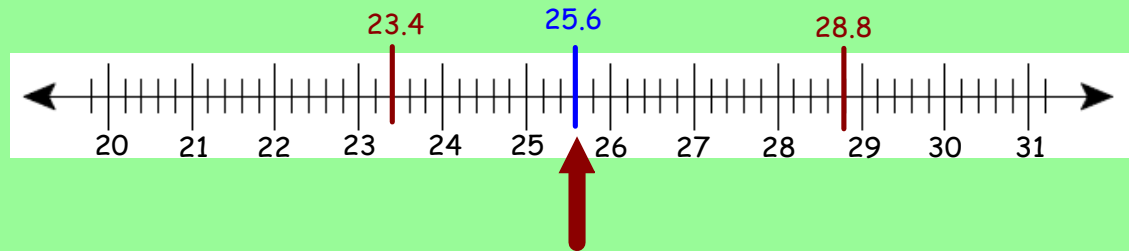


2) Find the median of the data and mark this on the number line.

There are 12 numbers --> your median in this example is between the 6<sup>th</sup> & 7<sup>th</sup> number:

$$6^{\text{th}} \text{ number} + 7^{\text{th}} \text{ number} = \frac{25.2 + 25.9}{2} = \frac{51.1}{2} = 25.55 = \boxed{25.6}$$

Mark this spot on your number line:

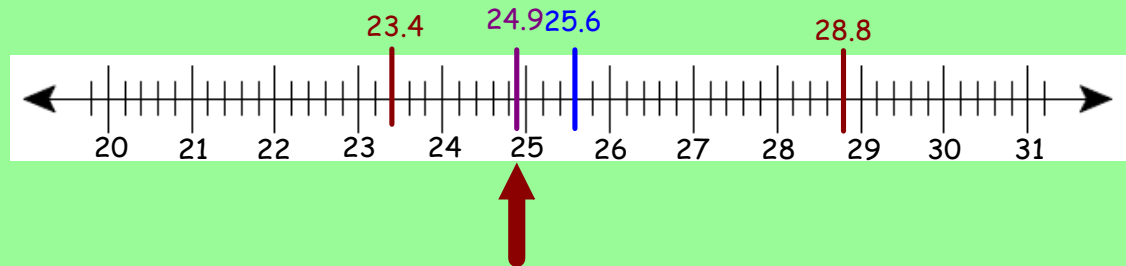


3) Find the **lower quartile** (median of the lower half of the data), and mark this on the line.

median (lower half) => the middle of the 1<sup>st</sup> set of numbers

$$\text{median (lower half)} = \text{so between the 3}^{\text{rd}} \text{ and 4}^{\text{th}} \text{ number} = \frac{24.8 + 25.0}{2} = \boxed{24.9}$$

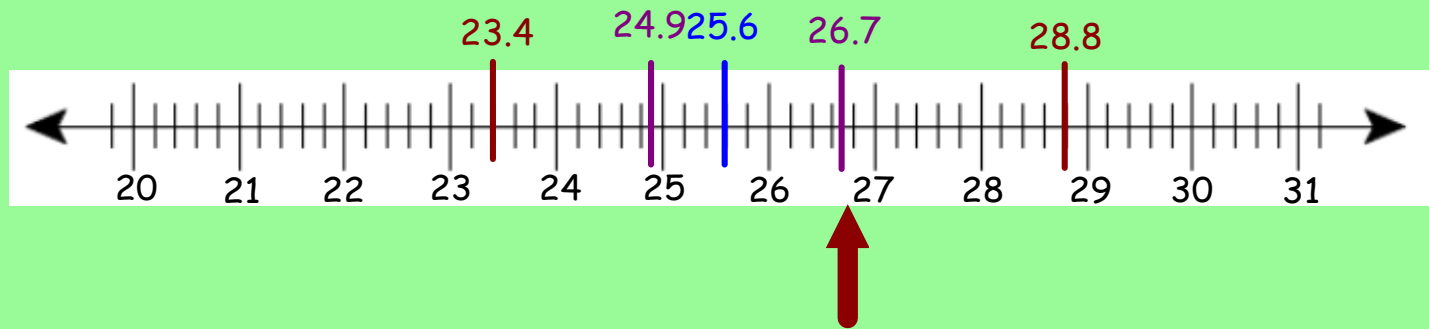
Mark this spot on your number line:



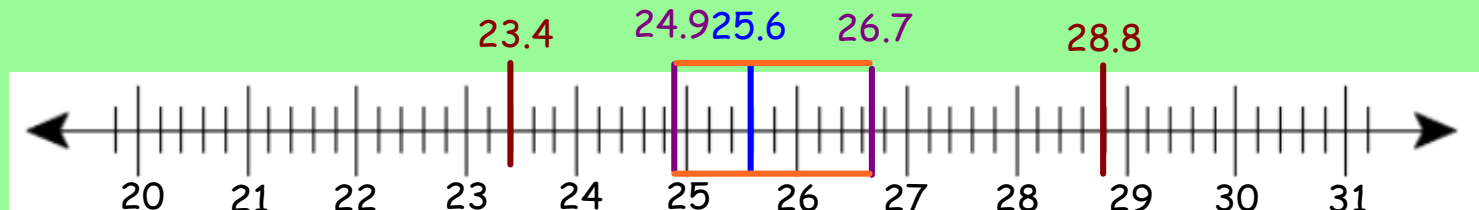
4) Find the **upper quartile** (the median of the upper half of the data), and mark this on the line.

median (upper half) = the middle of the 2<sup>nd</sup> set of numbers

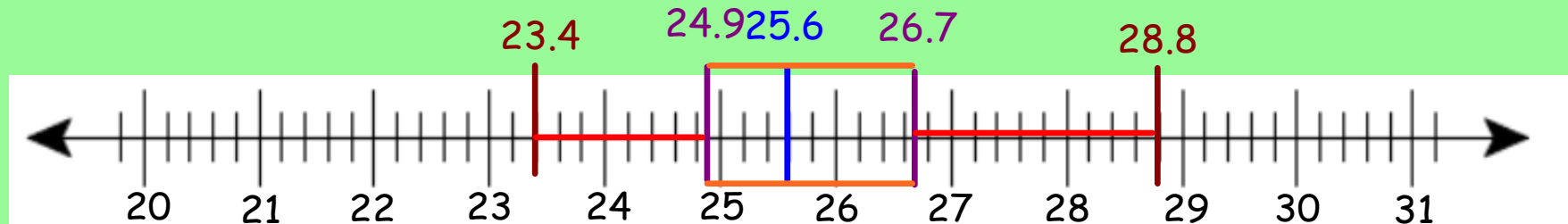
$$\text{median (upper half)} = \text{between the 9}^{\text{th}} \text{ and } 10^{\text{th}} \text{ number} = \frac{26.4 + 27.0}{2} = \boxed{26.7}$$



5) Construct a **box** connecting the upper and lower quartiles. Make sure to label the median, upper and lower quartiles.

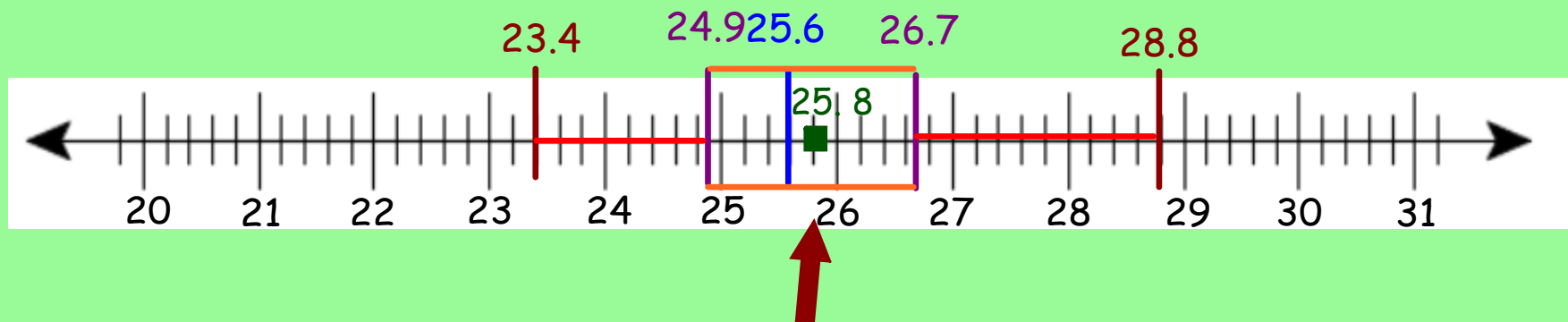


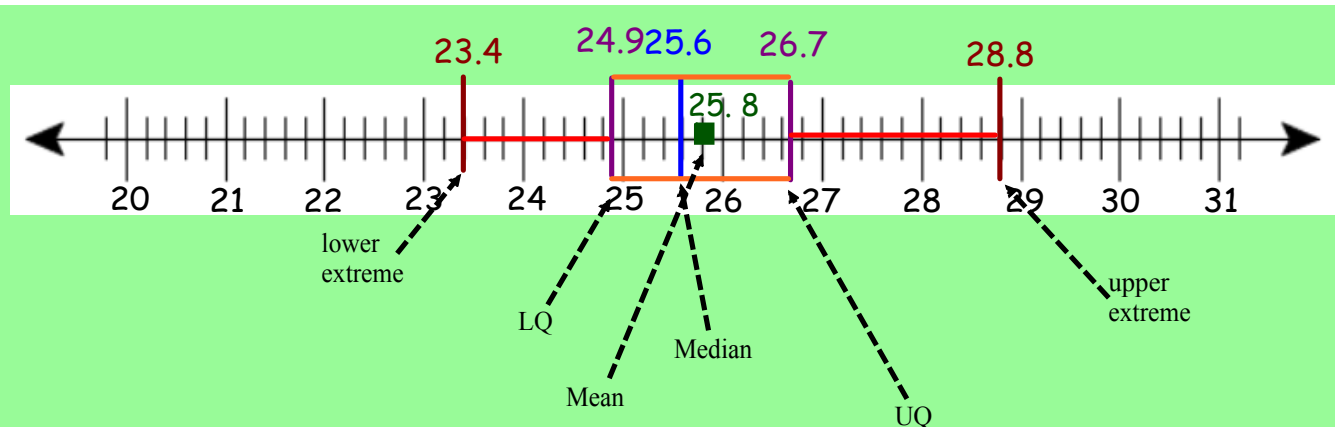
6) From the upper quartile to the upper extreme draw a line. From the lower quartile to the lower extreme draw a line.



7) Add in the mean by representing it as a box.

$$\bar{X} = \frac{\sum}{n} = \frac{309.3}{12} = 25.77 = \boxed{25.8}$$





1. What could be classified as the outliers of this data? Why?

Your lower and upper extremes could be considered outliers.

2. What does this box and whisker tell us about the data that just the "average" wouldn't?

An "average" wouldn't be able to tell you the spread of the data. (ie. Outliers, middle of the data, and where most numbers are.)

3. What would a typical time to eat at the restaurant?

The mean or median (25.6 and 25.8)

4. How much time would 50% of the people take to eat at the restaurant? (Between which two numbers?)

Numbers within the box (from 24.9 to 26.7)

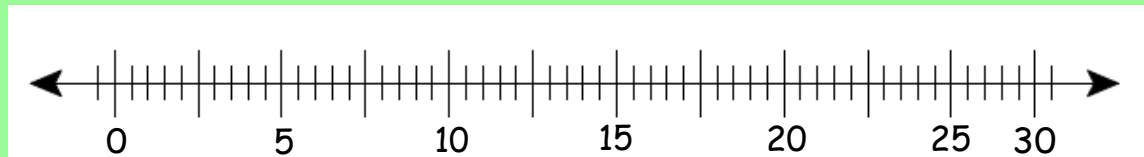
## Practice:

The basketball coach has recorded the statistics for home many points one of his basketball players has made throughout the season up until now. Construct a box and whisker.

2 2 4 8 10 14 16 20 22 23 23 24 25 25 25

You need to find and mark on your number line:

- |                                 |          |
|---------------------------------|----------|
| -the lowest and highest numbers | 2 and 25 |
| -the median                     | 20       |
| -the lower and upper quartiles  | 8 and 24 |
| -the mean                       | 16.2     |



## Classwork/Homework:

- Complete the practice question from the page before.
- Complete questions 9 - 14 on pages 20 and 21.
- For question 14, only construct a box and whisker, and do not worry about making one with a graphics calculator.



Box & Whisker Plot	
Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• highlights outliers</li> <li>• shows median</li> <li>• shows where the middle 50% of the values are found</li> </ul>	<ul style="list-style-type: none"> <li>• does not show all data values</li> <li>• does not indicate the number of data values</li> <li>• mean and mode cannot be found using the display</li> </ul>

## Warm Up:

The following table of data contains the average hours per week students in grade 10 watch television.

25.1	28.8	24.8	27.3	26.1
23.4	25.9	24.3	27.0	25.2
26.4	30.2			

Answer the following questions:

- 1) Create a box and whisker plot.
- 2) What is the range of values in the 50% of the data?
- 3) Give one advantage and one disadvantage of a box and whisker plot - in your own words.

Constructing a Box & Whisker on the Calculator:

- 1. Clear the Calculator:** Press  $Y=$  and use the CLEAR button to take any information that may be found on the Y lists seen on your screen. Then go up to the top and turn off any plots that may be turned on. Remember a plot is turned on if it is highlighted dark. To turn it off, press enter overtop of the Plot #.
- 2. Put in Data:** Hit STAT, make sure the EDIT is highlighted, and press enter at #1 (EDIT).
- 3. To clear L lists:** Put your cursor over the L list by pressing the up arrow and press CLEAR and then the down arrow and the data found in that list should disappear.
- 4. To enter data:** Put the cursor on the first spot in the column of the L list you are using. Preferably use the L1 list. Enter all the data you are using. Check to make sure all the data is in. Remember that you must put your cursor over the last piece of data to see how many there is in the list.
- 5. To put data in order:** Press STAT, use your down arrow to go to #2 SORT A (, and press ENTER. You will see your cursor blinking. Hit 2<sup>nd</sup> L1 (or #1) and then ENTER. Your calculator will say done. You can then go back to STAT, EDIT, ENTER and see the data in order.
- 6. To turn your plots on:** Hit 2<sup>nd</sup>,  $Y=$ . Turn your plot on by pressing enter on the #1 and your cursor will be flashing over the On, press ENTER. Your plot is now turned on.
- 7. To select a distribution:** Press the down arrow and then move your cursor over to the right with the use of the arrows until it gets to the second picture that looks like a box and whisker. Press ENTER. You have now selected the type of distribution.
- 8. To select what list to use:** Put your cursor beside the Xlist by pressing the down arrow. If it is already on the list you want, leave it, if it is not press 2<sup>nd</sup> and the list you want (for example if you want L1 press 2<sup>nd</sup> and L1 (or #1).
- 9. To Prepare your window:** Press WINDOW (in the blue keys). Here is what each of the items mean.  
Xmin = smallest # on number line if you were doing it by hand  
Xmax = largest # on number line if you were doing it by hand  
Xscl = 1  
Ymin = -1  
Ymax = 1  
Yscl = 1  
Xres = 1
- 10. To see your graph:** Press GRAPH (blue button)
- 11. To find answers on graph:** Press TRACE (blue button) and move the cursor over each line to get the information. You will be able to find the L extreme, Q1, Median, Q2, U extreme.
- 12. To find the Mean:** Press STAT, move the arrow over to CALC, press ENTER over #1 (1-var stats). At the blinking cursor press 2<sup>nd</sup>, and whatever list your data is in (for example L1 or #1), press ENTER. The spot where you see the X with a line over it is the mean.

### To Show Two Graphs at Same Time

- 1. Bring up stat plots:** Hit  $2^{\text{nd}}$ ,  $Y=$ . You will have #1 plot turned on to one by pressing enter over the 1: and then turning on the plot by pressing ENTER over the plot. You will choose one type for this plot. You then will give the data to use in Xlist by pressing  $2^{\text{nd}}$  and the data list.
- 2. Turning on a  $2^{\text{nd}}$  one:** Hit  $2^{\text{nd}}$ ,  $Y=$  and go down to 2: and press ENTER. Turn the plot on by pressing ENTER over the blinking cursor on ON. Move your arrow down to type and select your second type of graph you would like to use by pressing ENTER over it. Go to the Xlist and choose what data you would like to use by pressing  $2^{\text{nd}}$  and the data list.
- 3. Windows:** Make sure your windows are set appropriately to the graphs you are using by looking at the information above.
- 4. Seeing your graphs:** Press graph. This will show both of your graphs together.

## Practice:

- Using the data "Group 1: Average Reaction-Time Data" found on page 17, create a box and whisker.
- Create a second box and whisker using the data "Group 2: Average Reaction-Time Data" found on page 18.
- Answer the following:
  - a) which set of data is more spread out?
  - b) which set of data has outliers further away from the center?
  - c) which group had better reaction times? Why?

# Classwork:

- Complete question #14 on page 21 using the graphics calculators. Make a sketch of your box and whisker plot and label with the appropriate values (6 values).
- Complete question 17 on page 21 and 22. Please sketch the calculator's answer (label with values)

